AD-A168 798 DEVELOPMENT OF A VIDEO TAPE TO TEST TELECONFERENCING CODECS(U) DELTA INFORMATION SYSTEMS INC HORSHAM PA 23 AUG 85 NCS-TIB-85-2 DCA100-83-C-0047 1/1

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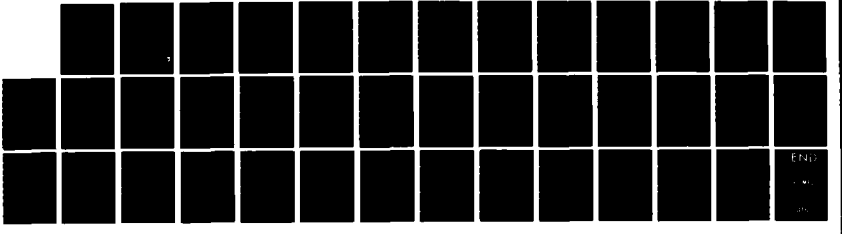

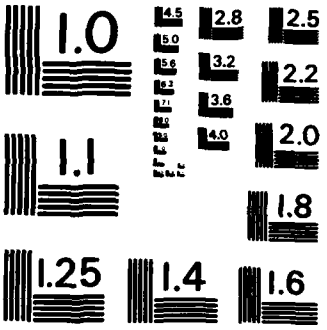

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

NCS TIB 85-2

NATIONAL COMMUNICATIONS SYSTEM

TECHNICAL INFORMATION BULLETIN 85-2

DEVELOPMENT OF A VIDEO TAPE TO TEST TELECONFERENCING CODECS

AUGUST 1985

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DEVELOPMENT OF A VIDEO TAPE TO TEST TELECONFERENCING CODECS

AUGUST 1985

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FOREWORD

Among the responsibilities assigned to the Office of the Manager, National Communications System, is the management of the Federal Telecommunication Standards Program. Under this program, the NCS, with the assistance of the Federal Telecommunication Standards Committee identifies, develops, and coordinates proposed Federal Standards which either contribute to the interoperability of functionally similar Federal telecommunication systems or to the achievement of a compatible and efficient interface between computer and telecommunication systems. In developing and coordinating these standards, a considerable amount of effort is expended in initiating and pursuing joint standards development efforts with appropriate technical committees of the Electronic Industries Association, the American National Standards Institute, the International Organization for Standardization, and the International Telegraph and Telephone Consultative Committee of the International Telecommunication Union. This Technical Information Bulletin presents an overview of an effort which is contributing to the development of compatible Federal, national, and international standards in the area of Video Teleconferencing. It has been prepared to inform interested Federal activities of the progress of these efforts. Any comments, inputs or statements of requirements which could assist in the advancement of this work are welcome and should be addressed to:

Office of the Manager
National Communications System
ATTN: NCS-TS
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DEVELOPMENT OF A VIDEO TAPE
TO TEST
TELECONFERENCING CODECS

AUGUST 23, 1985

Final Report

Submitted to:

NATIONAL COMMUNICATIONS SYSTEM

Office of Technology and Standards

Washington, DC 20305

Contracting Agency:

DEFENSE COMMUNICATIONS AGENCY

Contract Number - DCA100-83-C-0047

MODIFICATION P00004

Task - 3

Subtask - 1

D E L T A I N F O R M A T I O N S Y S T E M S, I N C.

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SECTION 1 INTRODUCTION AND SUMMARY

This document summarizes work performed by Delta Information Systems, Inc. for the office of Technology and Standards of the National Communications System, an organization of the U.S. Government, under contract number DCA100-83-C-0047 Modification P00004. The work was performed under Subtask 1 (Development of A Video Tape to Test Teleconferencing Codecs) under Task 3. The Office of Technology and Standards, headed by National Communications System Assistant Manager Marshall L. Cain, is responsible for the management of the Federal Telecommunications Standards Program, which develops telecommunication standards whose use is mandatory by all Federal agencies.

This report covers the design and production of a video tape for testing motion codecs. It is part of a program for comparative evaluation of motion codecs used for teleconferencing at 1.544 Mbs. The specific purpose of the tape is to provide pictorial material which may occur during both government and commercial teleconferences and which simultaneously stresses the capabilities of each codec sufficiently so that differences in performance will become apparent. The choice of material must lead to a completely impartial evaluation without favoring any particular algorithm, and must not be constrained by any present limitation of teleconferencing which will not exist in the future.

Section 2 of this report describes the relevant background material and information which were reviewed before starting the tape design. Subsequently, the various categories of picture

material which were candidates for the codec test tape are analyzed in Section 3. The multiple steps that were followed in the preparation of the tape are detailed in Section 4. An original scenario was prepared, a suitable studio selected, and a large variety of studio scenes and graphic material taped, followed by more scenes in actual teleconference settings. All this material, together with other tapes obtained from military organizations, was edited into a final test tape version. At the same time, a test signal tape containing mainly electronically generated signals was prepared. Section 5 summarizes reviews of the tape by many users. Section 6 contains the exact scenario of both tapes in a simplified tabular format. Section 7 gives a brief conclusion and recommendations for further efforts.

SECTION 2 BACKGROUND MATERIAL

2.1 Related Tasks

The contents and format of the test tape which forms the main output of this task are closely related to two other tasks of Contract DCA100-83-C-0047. They are:

- o Development of a methodology to test video codecs used in teleconferencing
- o Test and evaluation of teleconferencing video codecs transmitting at 1.5 Mbps

The test methodology not only calls for specific test signals and sequences to be included in the test tape but also determines its approximate length and the overall layout of its contents. Since this task is being performed concurrently with the design of the test tape, the necessary exchange of information was easily accomplished. On the other hand, the performance of the codec tests is still in the planning stage; however, some fundamental ideas have already been developed, and the test tape contents have been designed to satisfy all presently anticipated test and evaluation requirements.

2.2 CCITT/CCIR Material

A number of pertinent documents were reviewed for guidance in the task of test tape preparation. The one most directly applicable is in CCITT Draft Recommendation H.100 covering the split screen presentation of two sections of a conference. It is contained in Item 3 of Contribution No. 287 of CCITT Study Group

XV, dated March 1984. This method allows the efficient presentation of a common conference situation with best possible picture quality and therefore must be included in a good test tape.

The basic document covering evaluation of TV picture quality is CCIR REC 500-2, Method for the Subjective Assessment of the Quality of Television Pictures (Vol. XI, Part 1, XVth Plenery Assembly, Geneva 1982). Though intended for entertainment TV, it contains many statements directly applicable to the codec test tape and its application. They are:

- o Test pictures should be more critical than normal pictures
- o Observers should be well briefed and introduced to likely impairments.
- o Between 10 and 20 observers should be used for picture quality evaluation.
- o Scales for both absolute ratings of picture impairment and comparison of two impaired pictures are given.
- o Viewing conditions for picture evaluation are given.

A document entitled: Method for the Subjective Assessment of Visual Telephone Picture Quality was prepared by CEPT (Consortium of European PTT's), COST 211 Committee dealing with visual telephony, No. 211/82/5, dated 3-31-1982. It largely re-states the salient points of the above referenced CCIR Rec. 500-2. In addition, it contains recommendations for the type of test pictures, the length of the test scenes, and most pictures, the length of the test scenes, and most important, for a important,

for a rating period following each scene. Both still and moving pictures should be used. Moving pictures should be realistic in terms of a conference situation. Still pictures should include portraits and graphics. Test patterns should be excluded.

SECTION 3 TAPE REQUIREMENTS

3.1 General

All codecs inherently produce a deteriorated output picture. The deteriorations can be broadly separated into two catagories; picture quality and motion rendition. Loss of picture quality typically manifests itself by one or all of the following: Reduced resolution, poor color rendition, spurious patterns or artifacts. Deterioration of motion performance may show up as jerkiness, blurring, or partial or complete picture break up.

Consistent with the general philosophy of testing, the picture material should stress the codec performance close to or somewhat beyond its limits. This is necessary to accentuate the often small differences between codecs. A high quality analog input picture is required; indeed, the analog portion of the test set up must be essentially transparent. That makes it mandatory that only 1" tape be used for the test tape and for recording the codec output. Any failure to follow these rules will make it impossible to achieve significant and impartial results.

The imposition of stress on the codec appears to make artificial scenes such as a rotating disk or pendulum with various color and black/white patterns very desirable. Such patterns can produce a stronger and more measurable stress than ordinary scenes and thus help in identifying differences in codec performance. However, the variety and complexity of codec algorithms makes it impossible at this time to assume correlation between performance with natural and artificial scenes. In other words, in a

comparison of two codecs one unit may show worse deterioration with an artificial scene but perform better with a natural conference scene. Thus it is possible for the use of artificial scenes to preclude an impartial evaluation. This, however, does not rule out that in the future artificial scenes or patterns will prove to be valuable tools for codec performance testing.

The subsequent paragraphs briefly discuss the types of picture material which were considered for inclusion in the codec test tape.

3.2 Still Pictures

Still pictures for the evaluation of overall picture appearance should be high quality color slides of portraits and persons in typical surroundings. Such pictures show up mainly problems with color performance. Graphics such as print samples, typed pages, graphs and diagrams primarily stress the resolution capability of the codec system. Both are vital for a full evaluation. The picture material must be such that the analog picture is of excellent quality and in no way limited by, for instance, the resolution capability of the system. Still pictures should be considered for special tests such as transmission error conditions where motion is not a primary issue but may tend to confuse the evaluator.

3.3 Motion Scenes

3.3.1 Simulated Conference

Since the intended use of the codecs to be tested is for

teleconferences, scenes of typical conference situations represent the most important picture material for the test tape. It is impossible to cover the gamut of possible conference scenes. Since teleconferencing is relatively new, more applications are likely to be developed continuously. Various government agencies obviously will present different requirements and will not wish to be bound by the constraints often imposed by commercial teleconferencing operators. Therefore, the conference scenes should not be limited to the conventional arrangement of participants sitting at a conference table with a special fixed layout. The conferees should also be shown getting up, presenting materials at at a board or projection screen, and taking part in lively discussions. Camera panning and zooming should be used judiciously.

Most existing commercial teleconference installations provide the above functions to a limited extent. Therefore, exactly following only established commercial procedures would fail to produce a test tape which subjects the codecs to the stress which is needed to highlight differences in their performance. Thus it becomes necessary to include scenes which are staged to intentionally stress the codec to and beyond its performance limits which can easily be done is a TV studio setup. This is also expected to cover most situations likely to occur at future government agency conferences.

3.3.2 Action Scenes

It is expected that during many military, and also other

teleconferences, reference will be made to important events which have been recorded on video tape. For discussions of these events by all teleconference participants the video tapes will have to be transmitted via codecs. Therefore, it is desirable to include some scenes with considerable action on the tape. Military scenes obviously are preferred, but others such as sporting events need not be ruled out. Caution is necessary in the choice of action. For instance, on automobile race taken from overhead, in spite of very fast action, is a poor choice. The racing cars kept close to the center of the picture appear almost stationary while the surroundings move so fast that they are barely distinguishable even on an analog picture. Similarly, a missile shortly after launch against a sky background does not give relevant results.

3.3.3 Computer Animation

Computer generated animated picture material is gaining ever increasing popularity. It is very useful not only for commericals on entertainment TV but also for impressive presentation of an unlimited variety of data. Examples are animated curves, bar charts, pie charts, maps or military type displays, all featuring multi-colored rapid motion displays. This material can be recorded on tape directly out of the computer.

3.4 Test Signals

3.4.1 Standard Test Signals

Elaborate methods have been developed for end-to-end testing of analog TV systems. These techniques are directly applicable to

high quality, high bit rate digital TV systems which provide broadcast TV quality. But their relevance for codecs which yield quality significanly less than broadcast TV remains to be demontrated. In the related task for the development of test methodology, recommendations are made for the performance of a selected group of analog tests on codecs. But the usefulness of these recommendations remains to be proven. Obviously such test signals would be evaluated objectively with test instruments. Therefore, they should not be included in a test tape designed for subjective evaluation by a panel of observers but must be handled separately. However, it would be extremely valuable if correlation could be established between the subjective and objective tests because it would lead to a much less cumbersome and costly codec evaluation technique.

3.4.2 Artificial Motion

Many test signals can be generated electronically by means of conventional switching, special effects and test equipment to measure the ability of the codec to reproduce motion. Measured amounts of pixel change between frames can be produced. It is also possible to devise instrumentation to perform limited objective motion measurements. However, since correlation between artificial and natural motion has not been established, such signals, too, should not be included in a test tape designed for subjective evaluation but handled separately in further studies.

SECTION 4 TAPE PREPARATION

4.1 Studio Tape Scenario

After thorough review of the requirments summarized in Section 3, an initial scenario for the studio portion of the test tape was developed. It was recognized that the resulting tape would not be the final version. However, this scenario was made up to include, if possible, all scenes that required the use of one or more live TV cameras. The use of a studio facility requires considerable lead time and is quite costly; therefore, proper planning at this point saves both time and expenditure.

The initial studio scenario was made up with the objective of an ultimate length of up to 20 minutes. Its contents were as follows:

(A) Introduction

This part consists of a title and a test signal for calibration.

(B) Simulated Conference

A variety of about 12 separate scenes was designed to include most activities expected to occur in a conference. Six participants are shown entering and leaving, sitting, standing and walking. Shots of all six, groups of three, and close ups of a single person are included. Demonstrations and discussions using a marker board, viewgraph slides and maps are shown. Some of the participants wear lively patterned clothing and the scenes

generally include a lot of motion.

(C) Still Pictures

A selection of different types of pictures is included, such as standard SMPTE (Society of Motion Picture and Television Engineers) color slides, a typed page, print samples in various sizes and colors, a circuit schematic, a map with details in color, and an aerial photograph.

(D) Electronically Produced Scenes

This section is made up of portions of existing tapes with preferably military action and scenes generated by Dubner computer animation.

(E) Conclusion

This part contains the end title and a repeat of the calibration test signal.

In addition to the above, tentative plans were made for a separate test signal tape which would be produced at the time of final editing and not used for subjective evaluation. This tape contains selected standard analog TV test signals such as video sweep, composite test signal and modulated and unmodulated staircase and ramp signals. Artificial motion is produced for instance by switching between a window signal and a flat field and by producing outlines of special effect transition patterns on a flat field. These outlines are then moved across the screen in both directions at various speeds. Examples are a vertical bar or

a diamond shaped pattern originating in the center of the picture. The only signal not generated electronically is a resolution test chart which is recorded together with the other still pictures of the regular tape but used only on the test signal tape.

4.2 Facility Selection

Several firms were available locally to produce video tapes. The main business of these firms is production of TV commercials and a large variety of promotion and training material. They all have fully equipped studios, control rooms, recording and editing facilities available. Particularly the large firms are heavily oriented towards artistic production. For the special purpose of the test tape with minimal artistic but somewhat non-standard technical requirments, it became apparent that a somewhat smaller firm would be more flexible and responsive. Thus Center City Video was selected and fully lived up to expectations.

4.3 Studio Production

A studio set was constructed for the live scenes of the simulated conference. It consisted of two conference tables with three chairs each forming an obtuse angle. A viewgraph projector stood on a pedestal in the center. A projection screen, maps and a markerboard were mounted on the wall behind. The remainder of the background was covered with a patterned wallpaper and striped drapes. Two cameras equipped with zoom lenses on pan and tilt heads provided full flexibility for all desired shots. The still pictures were subsequently produced using a single camera and front or back lighting or projection depending on the format of

the picture material. Zooming on still pictures was used in selected instances.

Six semi-professional actors ("extras") were selected to be the teleconference participants. A program director supplied by Center City Video operated the switching equipment and gave instructions to the studio camera and video tape operators. The program director had an outline of the desired scenes but specific instructions were given by DIS personnel present in the control room. The scenes included the gamut from wide angle shots showing all participants to head and shoulder close-ups of a single person. Actions were designed to cover all gestures likely to occur during a teleconference, such as talking while seated, presentations at a marker board, and explanations of viewgraphs and maps. Some fairly lively discussions were included. Zooming, camera panning and tilting were used as appropriate.

4.4 Typical Teleconference Material

Representative scenes of present commercial teleconferences were taped in several different teleconference rooms. It would have been ideal to use portions of actual teleconferences but company privacy considerations make this generally impossible. Therefore, conferences using all available facilities had to be staged. The following rooms, each featuring a different layout, were utilized.

A. ATT-PMS

The ATT Picturephone Meeting Service room has the layout

shown in Fig. 4-1. The three face-to-face cameras are fixed and each provide a close-up of 2 people sitting at the conference table which accomodates 6 people. Switching between them is controlled by the microphones, with the conferee talking loudest shown on the output picture. The overview camera shows a fixed wide-angle shot of the whole conference table. The multipurpose camera has a remotely controlled pan, tilt and zoom capability allowing any shot from the whole room to extreme closeups. It can be used for following somebody walking but it is mainly intended to cover the marker board. A frosted glass panel which can be back lighted for transparencies is provided for graphics which are shown by means of an overhead camera with zoom capability. A 35mm slide camera is in the equipment room. The main camera control panel is in the center of the conference table convenient to the conference moderator. A duplicate control panel is in a corner of the room.

A considerable length of typical shots, using all cameras, was recorded, including a presentation at the marker board. Operation of the multipurpose and graphics cameras, being performed by untrained personnel, was somewhat rough but this is typical for a teleconference.

B. Satellite Business Systems

The SBS teleconference room, configured specifically for use by Aetna Insurance Company, is shown in Fig. 4-2. The two fixed face-to-face cameras each cover 3 conferees on one side of the table. The "black board" camera shows mainly the material on the

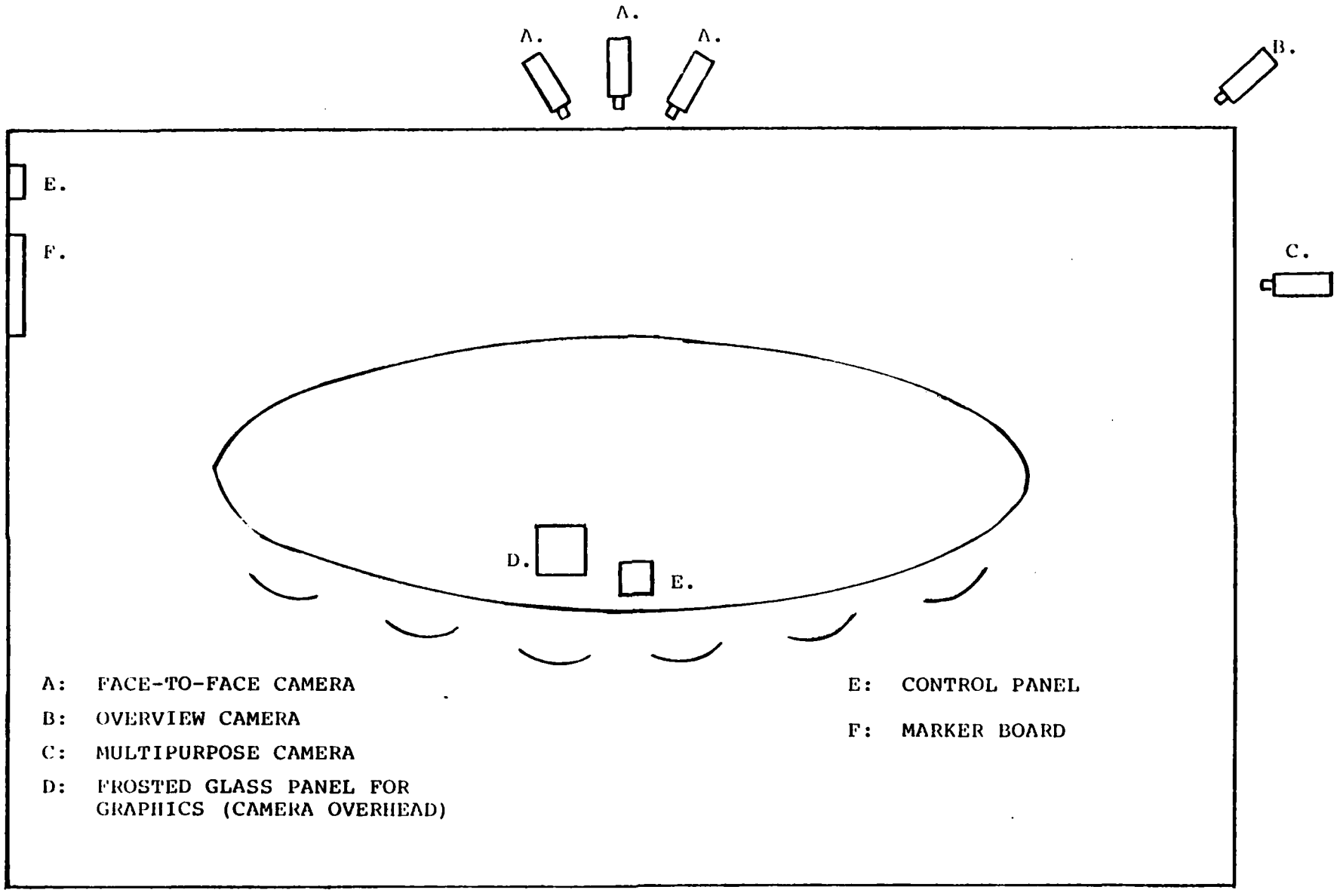

FIG. 4-1 PMS TELECONFERENCE ROOM

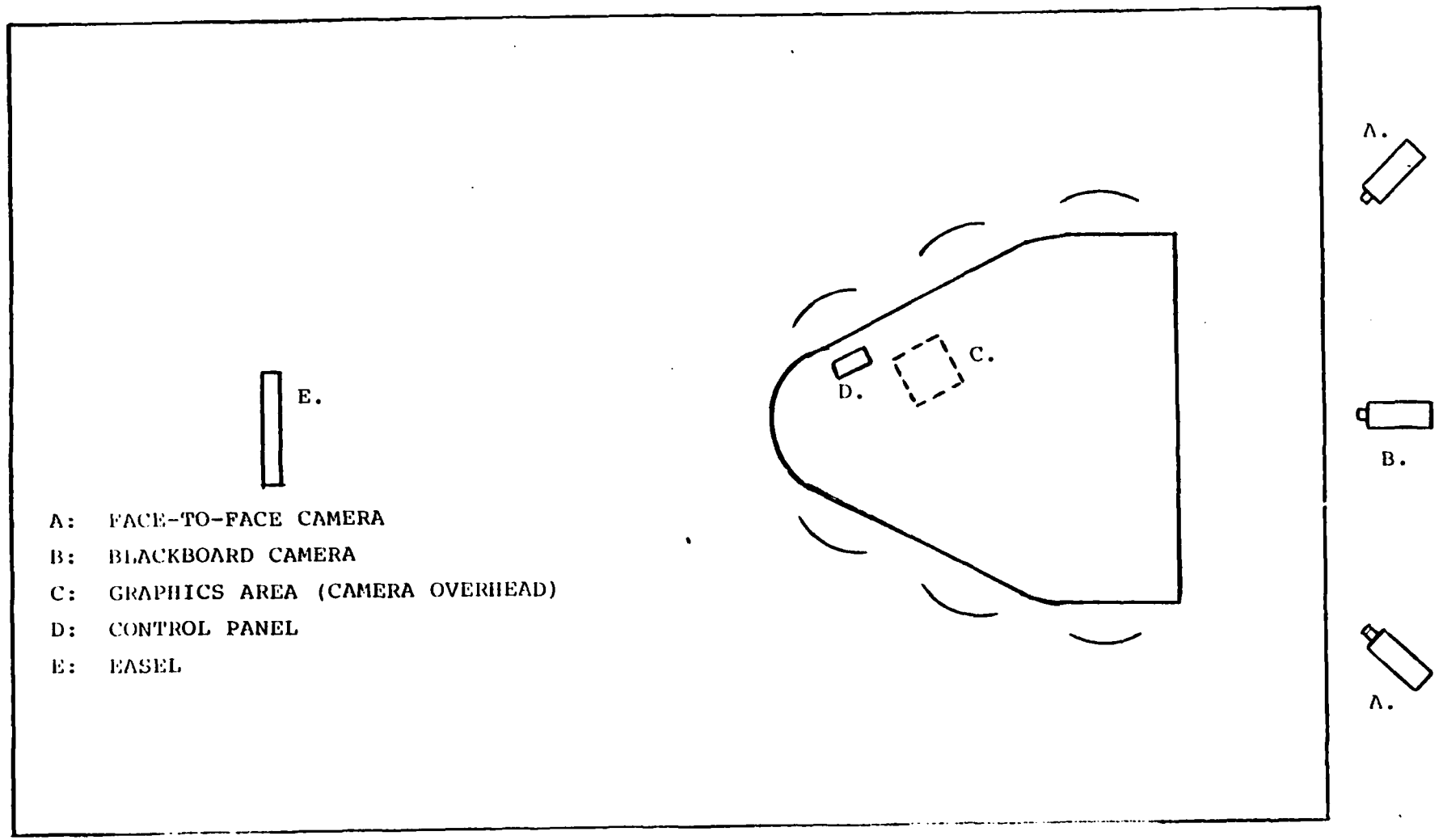

FIG. 4-2 SBS TELECONFERENCE ROOM

easel but has pan, tilt and zoom capability so that it can be used for other purposes. However, it cannot provide coverage of the whole conference. The graphics camera can be zoomed and focused. A slide camera is available in the equipment room. SBS mainly uses the principle of "continuous presence" which multiplexes the two face-to-face cameras and a freeze frame of the graphics camera. Therefore only a limited switching capability has been provided. For the purpose of the test tape, only a single picture can be handled at one time; thus the multiplexing feature could not be used. Separate typical pictures were recorded from all cameras.

C. ISACOMM

The ISACOMM teleconferencing room is shown in Fig. 4-3. Only a single face-to-face camera is used which has a pre-programmed pan and zoom capability to produce a variety of different views; namely 6 people, the 2 center conferees, and a single person with the possibility of an extreme close-up. A manual over-ride of these functions with a "joystick" controlled pan and tilt and separate zoom is available. The speaker's camera has one pre-programmed position showing the marker board with the upper body of the speaker; but the same manual override control allows following the speaker from his seat to the board and a tight close-up of a portion of the board. The graphics camera has the conventional zoom function and also a fine focus adjustment. A slide camera is provided in the equipment room. A joystick controlled electronic pointer can be superimposed on an outgoing freeze-frame picture. All these functions are software controlled

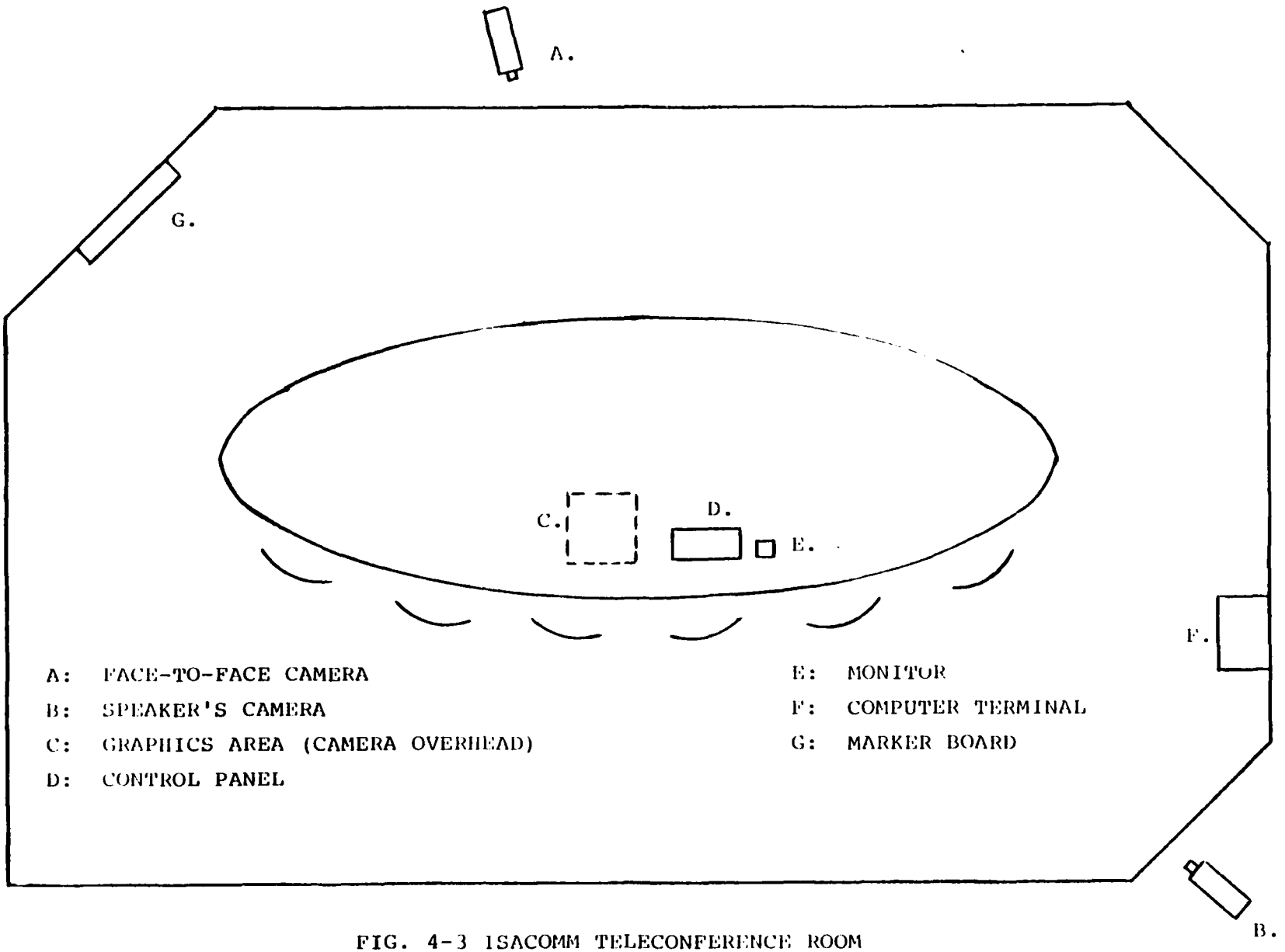

FIG. 4-3 ISACOMM TELECONFERENCE ROOM

from a very sophisticated control panel which is handled by a conferee. A miniature monitor is available next to it to check the operation. A computer terminal is used to generate animated graphics displays.

Typical pictures were recorded showing outputs from all cameras performing all the above described functions. The only exceptions were the pointer which is limited to the freeze frame mode, and unfortunately the computer prcduced animated graphics.

The three facilities in which recordings were made are representative of suppliers of commercial teleconferencing services. Though similar in their fundamental function, the three rooms differ drastically in detailed layout and equipment. Thus the scenes recorded in them are representative of the majority of commercial teleconferences held at this time. Undoubtedly, as this presently infant industry develops in the future, an ever larger variety of scenes with always lessening constraints will be used.

4.5 Editing

The tapes produced in the studio and the three teleconference rooms resulted in a large excess of material. Only the most significant scenes were retained, and even they were drastically shortened. Print samples produced by a "Chyron" character generator showing different size characters in all combinations of primary and secondary colors were inserted. Scenes of computer generated animation were taken from material available at Center City Video. Three sequences of military action were taken from

tapes obtains from the US Navy and Air Force. A few scenes from a tape provided by the Defense Communications Agency were added. Some similar scenes, mainly graphics, were shortened and combined in order to limit the overall tape length.

All taping of the simulated conferences resulted in a somewhat logical order of scenes. However, since a series of similar scenes may reduce the alertness of the evaluators, it was decided to rearrange all sequences into a random order. Scoring intervals of 10 seconds are included after each sequence. Three sequences featuring resolution and color rendition requirements are repeated at arbitrary spots on the tape to cross check monitor performance. For viewing these sequences the connections to the two monitors will be reversed to check whether possible differences in monitor performance may influence the evaluation. Only two exceptions from the randomization were made. The military scenes were kept together at the end of the tape. Following the military scenes, three identical scenes with moderate motion recorded to be used with a data link simulator which inserts artificial errors. This provides the optional feature to evaluate codecs under three levels of error conditicns.

The sequences on the edited test tape can be broadly put into several categories. The are: Still graphics (color and black and white), graphics with animation (zoom, pan or pointing), slow, moderate and lively motion with different backgrounds, computer animation, and military action. There are no distinct dividing lines, some sequences can fit into more than one category. The tape provides the gamut of present day commercial

teleconferencing, augmented by scenes typical for the much less constrained military environment, and looking towards future widely expanded teleconferencing applications.

SECTION 5 USER REVIEW

The edited test tape represented the best combined judgement of DIS personnel. In order to test the validity of this judgement, a 3/4" copy of this tape was presented for review to teleconferencing and visual communication experts in both Government Agencies and commercial organizations. Following is a summary of the reviewing organizations and personnel together with highlights of their collective comments.

The following Government and associated personnel viewed the test tape:

Maj. W. Benson, USAF - AFSITT

Mr. D. Bodson, NCS

Mr. T. Dickinson, USAF - AFXOORV

Mr. J. Elwell, USN-NUSC

Mr. J. Hart, USAF-AFSC

Dr. R. Heroux, USN-NUSC

Mr. C. Hollister, FEMA

Dr. C. Kelley, DARPA

M. R. Rydel, MITRE

Maj. P. Stewart, USAF-1947HSG/DCOV

Mr. F. Suraci, DCA-CCSO

In addition, the tape was reviewed by groups of technical and operational personnel of ISACOMM and SBS. The comments furnished by all the above showed considerable uniformity and are summarized herewith.

(1) The studio sequences of a simulated teleconference are useful to stress the video codecs. Lively motion and bright saturated colors and desirable. Both the studio environment and scenes in actual teleconferencing rooms are important.

(2) Almost any type material may be transmitted in a military or other U.S. Government teleconference. More flexibility than for commercial applications is needed. An example is medical diagnostic services which now employ analog TV. Tapes of military and other events are likely to be used.

(3) Transmission of typed material is very important. A conferee shown signing a document provides instantaneous and automatically verified promulgation of an order.

(4) Computer graphics and map displays are desirable.

(5) Zooming in on a single speaker and on graphics (such as typed page, aerial photo and map) is a meaningful codec test.

(6) The Chyron generated slides are very good because they allow evaluation of a wide range of color combinations.

(7) One purpose of the tape is to test what the codec can do, not to show what will generally be done with it. As such the test tape need not be constrained to material encountered in a conventional teleconference.

The overall reaction of the reviewers was that the test tape was adequate and fulfilled its intended requirements.

SECTION 6 FINAL TAPE SCENARIO

6.1 Subjective Evaluation Tape

The primary output of this task is the test tape which will be used during the next phase of this program for subjective evaluation of codecs in accordance with the previously developed test methodology. Following a color bar chart used for equipment check and a title slide, the tape consists of 49 sequences, 46 of which are devoted to the evaluation of basic codec performance parameters, such as resolution, color fidelity, motion rendition, and artifacts or spurious images. The last 3 sequences are used for evaluation of the effect of transmission errors and are separated by a 20 second interval necessary to allow for test equipment rearrangement. A scoring interval of 10 seconds follows each sequence. The total length of the tape is about 31 minutes. Deducting the "inactive" periods yields a duration of about 22.5 minutes for the 49 sequences to be evaluated, or an average of about 27.5 seconds per sequence.

The tape scenario is shown on Table 6-1 in a very concise form. The tape material is divided into 4 categories each of which contains 2 to 5 features. It is possible that a pertinent feature from another category is added. The absence of a specific feature is indicated by -. The source of each sequence and its duration are given. Necessary explanations are in the remarks column. A legend explains the symbols used for each category.

SEQ. NO.	SOURCE	STILL GRAPHICS MAT'L	STILL GRAPHICS SUBJ MATTER	ANIMATED GRAPHICS MAT'L	ANIMATED GRAPHICS SUBJ MATTER	ANIMATED GRAPHICS MOTION	GRAPHICS WITH PEOPLE SUBJ MATTER	GRAPHICS WITH PEOPLE CAMERA MOTION	GRAPHICS WITH PEOPLE POSITION	GRAPHICS WITH PEOPLE NUMBER	PEOPLE MOTION	PEOPLE POSITION	PEOPLE NUMBER	PEOPLE MOTION	PEOPLE BACK GROUND	PEOPLE CAMERA MOTION	DURATION (SEC)	REMARKS
-	E	C	S														20	COLOR BAR CHART
-	E	C	S														10	TITLE
1	C											D	6x1	A	B	X	20	
2	I											D	6	A	P	-	15	
3	E	C	P														20	
4	S											D	3+3	S	P	-	30	
5	C						B	X,Z	U	1	L						22	
6	C						M	X,Z	D	1	A				B		20	
7	P			B,C	M,V	X,Y											27	
8	E			C	Q	Q											23	COMPUTER ANIMATION
9	C											D	3+3	A	B	-	30	
10	D						V	-	U	1	A						20	
11	C	C	S														20	SMPTE
12	C			B	P	Z											14	AERIAL PHOTO
13	I			C	H	X											15	
14	P											D	6	S	P	-	13	
15	C	B	D,T														20	
16	D	C	P														30	
17	I											D	2,6x1	A	P	X,Z	44	
18	E	C	P														20	
19	S						E	X,Z	U	1	S						30	
20	C											D	1+1	S	P	-	30	
21	P											D	2+2+2	S,A	P	-	43	FREQUENT CAMERA SWITCHING
22	C						M	X,Z	U,W	1,2	L						35	
23	E			C	Q	Q											25	COMPUTER ANIMATION

SUBJECTIVE EVALUATION TAPE SCENARIO

TABLE 6-1

		STILL GRAPHICS		ANIMATED GRAPHICS			GRAPHICS WITH PEOPLE					PEOPLE					DURA-	
SEQ. NO.	SOURCE	MAT'L	SUBJ MATTER	MAT'L	SUBJ MATTER	MOTION	SUBJ MATTER	CAMERA MOTION	POSITION	NUMBER	MOTION	POSITION	NUMBER	MOTION	BACK GROUND	CAMERA MOTION	TION (SEC)	REMARKS
24	C											U	1+1	A,L	P	-	30	REPEAT OF 16 MONITOR CROSS CHECK
25	C	C	S														20	
26	D	C	P														30	
27	I			C	P	X,Y,Z											42	
28	C						B	X,Z	U,W	2	L				B		27	
29	C											D	1	A	B	Z	28	
30	I											D	1	A,L	P	-	30	
31	C			B,C	M,T	Z											27	
32	C											D	6	A	B	-	20	
33	E	C	P														20	
34	S			B	P	X											20	
35	C	B	D,T														20	REPEAT OF 15 MONITOR CROSS CHECK
36	P						B	X,Z	U	1	L						36	
37	C						F	X,Z	D	1	A						30	FINE DETAIL
38	C											D	3+3	A	B	-	29	SPLIT SCREEN
39	D			C	M	Q											30	COMPUTER ANIMATION
40	E	C	P,T														20	
41	D	B	P														20	
42	I						B	X	U	1	A						57	
43	C			C	M	X,Y											32	
44	A											U,W	Q	A	P,B	X	24	TITAN DISMANTLING
45	A											U	Q	A,L	P	X	33	FORWARD AIR CONTROLLER
46	N											U	Q	A,L	P,B	X,Z	51	UNDERSEA WARFARE
47 - 49	C,S																30	FOR PERFORMANCE TEST WITH ERRORS

SUBJECTIVE EVALUATION TAPE SCENARIO

TABLE 6-1 .

LEGEND TO TABLE 6-1

SOURCE

A Air Force

C Center City Video - Studio

D DCA

E Center City Video - Electronics

I ISACOMM

N Navy

P PMS

S SBS

ANIMATED GRAPHICS

Material

B Black & White

C Color

Subject Matter

H Hand Drawing

M Map

P Printed Material

T Typed Page

V Viewgraph

Motion

X Pan & Tilt

Y Pointing

Z Zoom

STILL GRAPHICS

Material

B Black & White

C Color

Subject Matter

D Diagram

P Print Sample

S Slide

T Typed Page

Graphics With People

Subject Matter

B Marker Board

E Easel

F Circuit Board

M Map

V Viewgraph

Camera Motion

X Pan & Tilt

Z Zoom

Position

D Sit

U Stand

W Walk

Motion

A Average

L Lively

S Slow

PEOPLE

Position

D Sit

U Stand

W Walk

Motion

A Average

L Lively

S Slow

Background

B Busy

P Plain

Camera Motion

X Pan & Tilt

Z Zoom

All Categories

Q Various

6.2 Test Signal Tape

The test signal tape is not a primary output of this task. It was developed because it required only a negligible added effort; and, after having been processed through the codecs, is expected to yield highly valuable results for future studies. The processed test signal tape will not be shown to the jury of evaluators who determine the official ranking of the codecs. Its expected initial use will be to determine what correlation can be achieved between those official subjective results and the objective measurements.

The scenario of the test signal tape is shown on Table 6-2. It contains the standard test signals suggested in the test methodology task for objective measurement of the pertinent analog performance parameters and the signals which may lead to a technique for objective motion measurements. Several sequences for subjective motion evaluation have been added. These sequences which are designed to demonstrate codec motion performance under high stress were not deemed suitable for inclusion in the subjective evaluation tape because they have no direct relation to material that may be expected to occur during an actual teleconference. The duration of each sequence is approximately one minute which should allow sufficient time for measurements without producing an unduly lengthy tape.

TABLE 6 - 2

TEST SIGNAL TAPE SCENARIO

Sequence No.	Description	Purpose
1	Color Bar Chart	Level check
2	RETMA Resolution Chart	Subjective resolution check
3	Gray Scale Chart	Subjective check of appearance of flat gray areas
4	Composite Test Signal - consisting of modulated 12.5T sine square pulse, 2T pulse, vertical white bar	Chrominance-to luminance gain and delay inequality, line time and short time waveform distortion
5	Video Sweep (with markers)	Amplitude vs. frequency response, filter parameters, luminance and chrominance sampling rates.
6	5 Step staircase, APL=50%	Luminance nonlinearity
7	5 Step staircase, APL=90%	Dynamic gain of picture signal
8	5 Step staircase, APL=10%	and sync signal
9	5 Step modulated staircase, APL= 50%	Differential gain
10	5 Step modulated staircase, APL= 90%	Differential phase
11	5 Step modulated staircase, APL= 10%	
12	Ramp	Luminance sampling precision
13	Modulated Ramp	Chrominance sampling precision
14	3 Level Chroma	Chrominance-to-luminance intermodulation Chrominance nonlinear gain and phase

Sequence No.	Description	Purpose
15	Switch between white window & black field, 3 times 10 seconds each.	Objective motion measurement
16	Switch between yellow & blue field, 3 times 10 seconds each.	Objective or subjective motion response evaluation.
17	Vertical black bar moving across white field, both directions, various speeds	Subjective evaluation of artificial motion, compared to natural motion
18	Black diamond shaped outline on white field, moving out from and in toward center, various speeds	Subjective evaluation of artificial motion, compared to natural motion

SECTION 7 CONCLUSION AND RECOMMENDATIONS

The principal output of this task consists of the 1" video tape which will be used for subjective evaluation of codecs. As described in the preceding sections of this report, great care has been taken to facilitate an impartial and dependable evaluation of the resulting codec output tapes. In addition to complying with CCIR and CCITT recommendations, the tape represents the combined ideas and suggestions of many experts in both commercial and military and civilian government teleconferencing. Thus all reasonable steps were taken to cover present and forseeable aspects of teleconferencing, and to achieve reliable and meaningful codec test results.

The test signal tape is a secondary output of this task and is recommended for further utilization. At present the only meaningful evaluation of motion codecs is subjective. This method is cumbersome and costly. It would be highly desirable to develop techniques for objective measurements. The test signal tape contains the standard signals for conventional analog tests. It is recommended to compare the results of the subjective evaluations with the objective measurements and to determine the degree of correlation between them. The expected result is a simplified methodology for motion codec testing which may reduce the need for subjective evaluation.

12 4/3

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188
Exp Date: Jun 30 1986

1a REPORT SECURITY CLASSIFICATION: Unclassified	1b RESTRICTIVE MARKINGS:
2a SECURITY CLASSIFICATION AUTHORITY:	3 DISTRIBUTION/AVAILABILITY OF REPORT: Unlimited
2b DECLASSIFICATION/DOWNGRADING SCHEDULE:	
4 PERFORMING ORGANIZATION REPORT NUMBER(S):	5 MONITORING ORGANIZATION REPORT NUMBER(S): NCS TIB 85-2
6a NAME OF PERFORMING ORGANIZATION: Delta Information Systems, Inc. / 6b OFFICE SYMBOL (If applicable):	7a NAME OF MONITORING ORGANIZATION: National Communications System
6c ADDRESS (City, State, and ZIP Code): Horsham Business Center, Bldg. 3 300 Welsh Road Horsham, PA 19044	7b ADDRESS (City, State, and ZIP Code): ATTN: NCS-TS Washington, DC 20305-2010
8a NAME OF FUNDING/SPONSORING ORGANIZATION: National Communications System / 8b OFFICE SYMBOL (If applicable): NCS-TS	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: Contract DCA100-83-C-0047
8c ADDRESS (City, State, and ZIP Code): Washington, D.C. 20305 ATTN: NCS-TS	10 SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO: 33127K / PROJECT NO: / TASK NO: / WORK UNIT ACCESSION NO:
11 TITLE (Include Security Classification): Development of a Video Tape to Test Teleconferencing Codecs	
12 PERSONAL AUTHOR(S):	
13a TYPE OF REPORT: Final / 13b TIME COVERED: FROM _____ TO _____	14 DATE OF REPORT (Year, Month, Day): 85-08-23 / 15 PAGE COUNT: 37
16 SUPPLEMENTARY NOTATION:	

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Video Teleconferencing, Test Tape, Codecs

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This report covers the design and production of a video tape for testing motion codecs. It is part of a program for comparative evaluation of motion codecs used for teleconferencing at 1.544 Mbs. The specific purpose of the tape is to provide pictorial material which occur during both government and commercial teleconferences and which simultaneously stresses the capabilities of each codec sufficiently so that differences in performance will become apparent. The choice of material must lead to a completely impartial evaluation without favoring any particular algorithm, and must not be constrained by any present limitation of teleconferencing which will not exist in the future.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT: ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION: Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL: Dennis Bodson	22b TELEPHONE (Include Area Code): (202) 692-2124 / 22c OFFICE SYMBOL: NCS-TS

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

END

FILMED

12-85

DTIC